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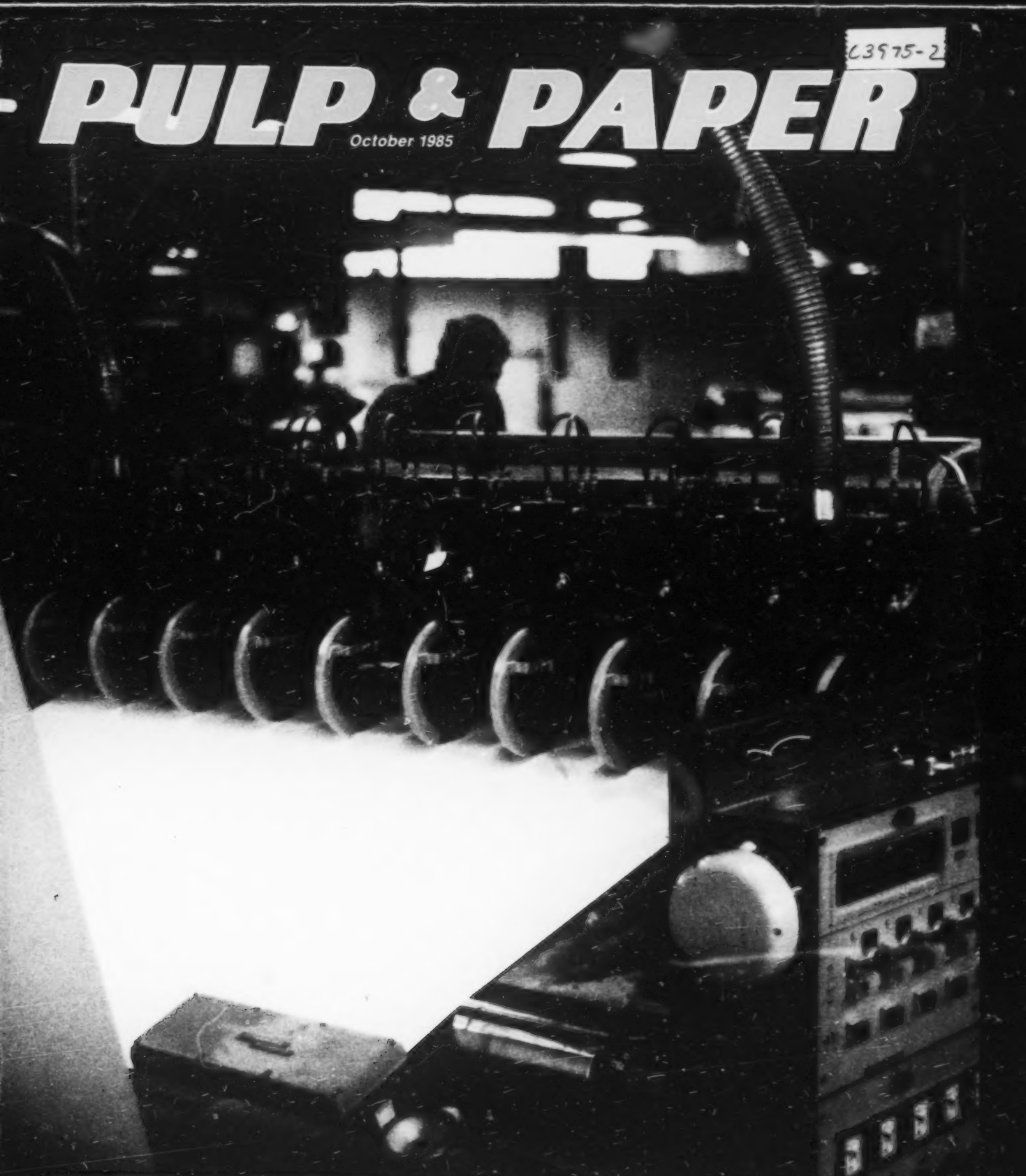
PULP & PAPER

October 1985



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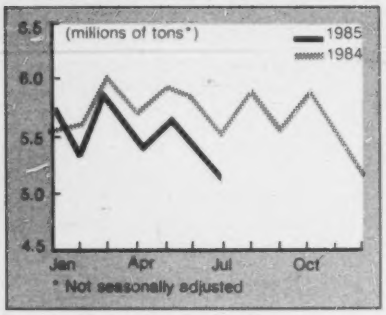
U.S. paper and board production



U.S. production of paper and paperboard totaled 5.3 million tons in July, down 4.0% from July 1984, according to American Paper Institute figures. Paper production dropped 1.8% compared with last year, but most of the decline was in paperboard production, which dropped 6.1%. The seasonally adjusted annual rate through July stood at 66.5 million tpy, down 4.2% from the rate last July. The trend of production is up somewhat from the second-quarter rate of 65.5 million tpy, but still lags the first-quarter rate of 67.7 million tpy.

Among major grades, uncoated free sheet and tissue continued to be the only grades showing gains over last year, rising 3.2% and 1.3% through July, respectively. Uncoated groundwood, down 10.6% through the first seven months, and packaging papers, down 9.8%, were the biggest losers. Unbleached kraft paperboard was down 5.8% through July, with production for export off 23.4%. Adjusted for an extra day this July, corrugated box shipments were down 0.6% compared with July 1984.

Canadian newsprint shipments declined 4.1% in July to 728,000 tons, or 85% of capacity, the Canadian Pulp & Paper Assn. reported. July pulp operating rates were 87%. ■

	Latest month (000 short tons)		% change from year ago	Annualized year-to-date (000 short tons)	% change from year ago
PAPER & PAPERBOARD PRODUCTION[1]					
Newsprint	July	495	9.8	5,486	−1.6
Uncoated groundwood (s)	July	114	−10.2	1,440	−10.6
Coated paper (s)	July	455	−4.8	6,043	−2.8
Uncoated free sheet (s)	July	778	10.0	9,595	3.2
Other printing/writing	July	104	−8.8	1,342	−9.4
Total packaging and other paper (s)	July	414	−14.5	5,188	−9.8
Tissue	July	390	−2.7	4,898	1.3
Total paper	**July**	**2,713**	**−1.8**	**33,992**	**−2.0**
Unbleached kraft paperboard	July	1,312	−5.9	16,347	−5.8
Semichemical medium	July	412	−5.5	5,007	−3.8
Bleached paperboard	July	314	−8.7	3,947	−3.8
Recycled paperboard	July	573	−5.4	7,619	−3.1
Total paperboard	**July**	**2,611**	**−6.1**	**32,920**	**−4.6**
Total U.S. paper and paperboard output	**July**	**5,324**	**−4.0**	**66,911**	**−3.3**
PULP, WASTEPAPER & FIBER[2]					
Total U.S. woodpulp production	June	4,442	−5.3	54,331	−3.1
Market pulp production	June	568	2.5	6,900	1.3
Wastepaper consumption at paper/board mills	June	1,268	−2.0	15,259	−5.5
Pulpwood consumption (cords)	June	6,943	−4.4	86,416	−2.2
CONVERTED PRODUCTS STATISTICS[3]					
Corrugated box shipments (billion ft²)	July	22.025	3.2	155.438[6]	16.5
Containerboard inventories at U.S. box plants and mills	July 1	2,838	−2.9		
INTERNATIONAL TRADE[2]					
U.S. paper imports (including products)	June	887	−7.9	11,160	8.6
Imports of Canadian newsprint	June	667	−6.8	8,204	9.8
U.S. paper exports (including products)	June	369	−11.9	4,000	−10.7
Exports of unbleached kraft linerboard	July	153	−13.1	1,693	−23.4
Exports of woodpulp	June	372	21.2	3,862	4.8
Norscan pulp inventories[4]	July 31	1,513	4.4		
Norscan pulp operating rates[4]	July	84%	91%	79%	86%
CANADIAN STATISTICS[5] *(reported in metric tons)*					
Total newsprint shipments	July	728	−4.1	5,214[6]	.2
Operating rates	July	85%	98%	92%	92%
Inventories held by U.S. consumers	July 31	1,505	.6		
Other paper/board shipments	July	244	10.4	1,739	9.1
Woodpulp shipments (export only)	July	611	5.5	4,039[6]	7.9
Operating rates	July	87%	95%	88%	84%

1. American Paper Institute. 2. API, Bureau of Census, American Pulpwood Assn. 3. Fiber Box Assn., Paperboard Packaging Council. 4. North American/Scandinavian paper-grade market pulp. 5. Canadian Pulp & Paper Assn. 6. Not annualized. (s) = shipments.

PAPER-GRADE CHEMICAL MARKET PULP: Too much production as new mills come onstream

Grade structure: Paper-grade chemical market pulp is sold in the open market and does not include captive pulp used onsite or shipped to affiliated mills within North America. Pulp is divided into grades based on whether it is made from softwood or hardwood fiber, whether it is produced by the sulfate (kraft) or sulfite pulping process, and whether it is bleached, semibleached or unbleached.

Northern bleached softwood kraft (NBSK) is the premium pulp grade because of its long fiber length and strength, although papermakers have been making more use of southern pine and hardwoods. Market pulp is sold in sheets, flash-dried bales, or rolls. U.S. paper pulp statistics include more than than 1 million tons of fluff pulp used in diapers.

Production/capacity: Canadian production of chemical paper-grade market pulp declined slightly to just below 6.0 million metric tons in 1984 due to the impact of the ten-week British Columbian labor dispute. U.S. output jumped 9% to a record 5.2 million tons, reflecting the supply gap created by the British Columbian industry shutdown plus startup of new capacity in the U.S. South.

Canadian pulp output in 1985 is expected to be slightly higher than a year ago, while U.S. production is expected to be essentially flat. Operating rates in Canada and the U.S. this year are expected to average only about 88%.

North American and Scandinavian producer inventories dropped from a recent peak of about 1.8 million metric tons in February to about 1.5 million tons at the end of July as the result of heavy downtime. Further curtailments will be needed because of current world oversupply caused by the recent startup of a large number of new mills.

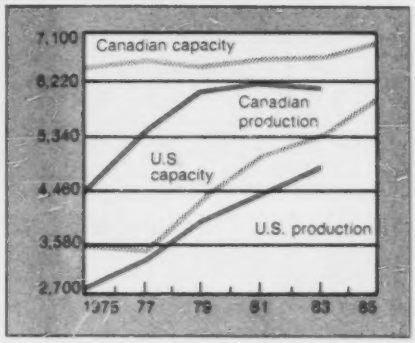
Pricing: Pulp prices began to bottom out this spring as heavy downtime reduced inventory levels. From a peak of $540/ton during the British Columbian labor dispute last spring, the U.S. list price for NBSK tumbled to $425/ton by late summer. This is about the same as price levels in Europe—translated from local currencies in which most sales are now taking place. Hardwood pulp prices have been even weaker, especially in Europe where nontraditional producers (Portugal, Brazil, South Africa, etc.) now have an important influence.

Current world price levels are unprofitable for many North American mills. Even with the recent weakening of the U.S. dollar, U.S. and Canadian mills are still at a cost disadvantage with producers in Scandinavia and nontraditional producing countries.

Unfortunately, the new capacity coming onstream will make any increase in pulp prices difficult before 1986—at the earliest. The outlook beyond 1986, however, looks brighter because of a lack of major new expansions before the early 1990s and forward integration of some U.S. market pulp capacity into white paper production.

Year-end U.S. market pulp prices in $/metric ton for NBSK: 1976, $410; 1977, $342; 1978, $375; 1979, $460; 1980, $530; 1981, $530/$565; 1982, $440; 1983, $450; 1984, $510; 1985 (mid-year), $425.

SUPPLY/DEMAND (000 tons)



FORECAST (000 metric tons)

	1983	1984	1985e
United States			
Production	4,723	5,153	5,150
Capacity	5,335	5,489	5,876
Utilization rate	88.5%	93.9%	87.6%
Imports	2,448	2,679	2,500
Exports	2,470	2,559	2,635
Apparent U.S. consumption	4,701	5,273	5,015
Canada			
Production	6,083	5,975	6,100
Capacity	6,840	6,885	6,917
Utilization rate	86.6%	86.8%	88.2%

e = Estimate.

TOP PRODUCERS (000 tpy)

	Annual capacity	Market share (%)
1. Weyerhaeuser[1,2,3,5,6]	900	7.0
2. Georgia-Pacific[1,2,5]	700	5.5
3. International Paper[1,2,6*]	630	4.9
4. P & W[1,2]	580	4.5
5. GLFP[1,2,3]	575	4.5
6. Westar Timber[1,3]	570	4.5
7. Canadian For. Prod.[1,3,4]	565	4.4
8. B.C. Forest Products[1,3,4]	480	3.8
9. MacMillan Bloedel[1,3,4]	460	3.6
10. GN Nekoosa[1,2,3]	410	3.2

Market share of top five companies: **26.4%**

Market share of top ten companies: **45.3%**

North American capacity (1985): **12.793 million metric tons**

Note: Several companies with major holdings in the market pulp sector are not shown above to avoid double counting of capacity: Noranda, 610,000 tpy (49% of MB, 50% of Northwood, 100% of Maclaren, 100% of Fraser); Canadian Pacific 600,000 (54% of Great Lakes, 100% of CIP); and Mead 480,000 tpy (50% of Northwood, 50% of Brunswick, and 28% of BCFP).

* Exact capacity is difficult to estimate because some of the company's mills also make dissolving pulp.

1. Bleached softwood kraft. 2. Hardwood kraft. 3. Semibleached softwood kraft. 4. Unbleached kraft. 5. Bleached hardwood kraft. 6. Fluff pulp.

• UPIU workers settled with **Stone Container Corp.** at its 1,145-tpd kraft board and linerboard mill in Hopewell, Va. The new three-year contract, effective July 31, calls for a ratification bonus of $1,100 in the first year and general wage increases of 3% in each of the remaining two years, expiring July 31, 1988.

• UPIU workers at **French Paper Co.**'s 60-tpd fine papers mill in Niles, Mich., ratified a new two-year contract, effective Aug. 22. The new agreement calls for pay hikes of 4% each year and expires Aug. 22, 1987.

• UPIU members continue to strike at **Georgia-Pacific Corp.**'s 1,500-tpd bleached paper, tissue, and paperboard mill in Crossett, Ark. Since the 1,100 workers began striking on June 19, the mill has operated with salaried employees. No meetings have been held and none are scheduled.

• **Newton Falls Paper Mill Inc.** has settled with UPIU workers at the 400-tpd fine printing and publication papers facility in Newton Falls, N.Y. The new three-year contract calls for pay hikes of 2% on Aug. 15 and 2% Feb. 15, 1986 for the first year; 2% on Aug. 15, 1986 and 3% on Feb. 15, 1987 of the second year; and a 4% general wage increase on Aug. 15, 1988, when the three-year contract expires. ■

Five-year pact ends lockout at Simpson mill

Members of the Assn. of Western Pulp & Paper Workers at Simpson Paper Co.'s 640-tpd Fairhaven, Calif., bleached kraft pulp mill returned to work after ratifying a new five-year labor contract, ending a lockout that began on May 20 (*P&P*, July, p. 39). The mill was idle throughout the work stoppage.

The new agreement follows the West Coast wage increase pattern of $1,000/4%/4.5% in the first three years, with the final two years' wage increases to be based on an average of settlements in 1987 and 1988. The contract expires July 1, 1989.

• **St. Joe Paper Co.** has settled with UPIU members at its 1,300-tpd linerboard mill in Port St. Joe, Fla. Effective July 29, the three-year contract calls for pay hikes of 3%/3%/3%, expiring July 31, 1988. ■

SALES/EARNINGS

Sales up, profits down for Canadian industry

The strength of the U.S. dollar continued to help earnings of Canadian pulp and paper companies during the second quarter. But this was more than offset by further deterioration in market pulp prices and the heavy downtime which caused two major producers to report losses for the second quarter.

Newsprint and groundwood paper markets remained fairly satisfactory for most producers. Lumber prices began to show some improvement late in the quarter. Nevertheless, the ten companies included in the accompanying table reported a 16.4% decline in profits on a 9.3% increase in sales. Also, after-tax profit margins averaged only about 2.4% of sales.

Newsprint held up. Consolidated-Bathurst Inc. reported a 63.5% increase in its second-quarter earnings (excluding a C$10.9-million extraordinary credit in the 1984 quarter, which resulted in a slight decline in net income). Con-Bath attributed the increased earnings to better pound-sterling and U.S. dollar exchange rates, higher productivity at its newsprint mill in the U.K., and improvements in both the newsprint and groundwood specialties markets (partially offset by sharply lower margins in bleached pulp).

Abitibi-Price Inc. reported a 7.4% slip in earnings and noted that newsprint shipments declined slightly in the second quarter from the first three months of 1985. Most of the Abitibi newsprint mills took downtime, but the two groundwood paper mills operated nearly at capacity. Abitibi expects newsprint and groundwood paper sales to continue at about the present level for the rest of 1985.

Domtar managed to produce earnings of C$18.7 million, despite a strike at its Quevillon, Que., market pulp mill (settled during the second quarter) and reduced profits from fine papers. These difficulties more than offset improved results in the newsprint market. Another firm benefiting from the improved newsprint and coated publication paper markets was British Columbia Forest Products Ltd., which reported a 20.3% increase in profits.

Red ink from market pulp. The sharp slide in market pulp prices took its toll on heavy producers in both eastern and western Canada. Great Lakes Forest Products Ltd., one of the most efficient producers, reported a loss of C$1.7 million for the second quarter, which it also blamed on lower prices for fine papers and lumber.

In western Canada, Canfor Corp., a major market pulp and lumber producer, posted a loss of $12.1 million

Canadian paper industry second-quarter results.

Companies	Sales	Change 1985/84	Earnings[1]	Change 1985/84
Abitibi-Price	C$662,354	12.9%	C$21,307	−7.4%
British Columbia Forest Products	290,100	10.4	7,100	20.3
Canfor Corp.	307,400	13.1	(12,100) *	n.m.
Cascades Inc.	68,600	39.4	4,000*	n.m.
Consolidated-Bathurst	445,100	1.4	24,200	63.5*
Domtar	527,500	1.0	18,700*	−15.0*
Donohue	105,600	−11.2	4,200	−52.3
Great Lakes Forest Products	146,819	−6.5	(1,657)	n.m.
MacMillan Bloedel	598,000	11.9	7,800	−17.0
Rolland	76,200	8.1	1,225*	−48.3
Scott Paper	63,338	20.4	2,664	25.4
Total	**C$3,291,011**	**9.3%**	**C$77,439**	**−16.4%**

1. Income after taxes from continuing operations, excluding most significant nonrecurring items in both years.

*Abitibi-Price: excludes 1984 extraordinary loss of $2,350,000; Canfor: excludes 1985 extraordinary gain of $3,500,000; Cascades: excludes 1985 special gain of $4,600,000; Consolidated-Bathurst: excludes 1984 special gain of $10,900,000; Domtar: excludes special gains of $1,300,000 in 1985 and $1,500,000 in 1984; Rolland: excludes 1985 credit of $935,000.

( ) = Loss. n.m. = Not meaningful.

tion of the dollar, slower growth in Europe relative to the U.S., and little improvement in access to such markets as Japan, according to Irene W. Meister, API vice president-international. U.S. real GNP surged 6.8% in 1984 compared with between 2% and 3% growth for the majority of European economies.

In 1984, U.S. exports of pulp, paper, paperboard, wastepaper, and converted products increased by 3% to 11.3 million short tons. Without the inclusion of wastepaper export tonnage—which jumped 25.7% to 3.3 million tons in 1984—U.S. paper industry exports decreased 3% to 8.1 million tons.

Import influx. Meanwhile, imports jumped 18.8% to a record 15.7 million tons. In addition to the increased imports of market pulp and newsprint that the U.S. has traditionally imported from Canada, "a sharp influx of printing and writing papers, which have not traditionally been a major import item" occurred, according to Dr. Meister. These imports reached about 2 million tons, almost double the 1983 level, according to "Exports of Pulp, Paper, Paperboard and Converted Products to World Markets—1984."

Total U.S. paper industry exports to western Europe fell 3.6% to 2.86 million tons, with pulp exports dropping 6.7%. Paper and board exports were 5.6% lower than in 1983. In the same period, total Swedish and Finnish exports of paper and board increased 10.3% and 13.6%, respectively, with a large proportion of the tonnage destined for the western European market.

In contrast to European activity, the Japanese economy achieved a 5.8% growth rate in 1984, fueled by strong export demand. Paper and paperboard consumption reached a record level of 21.1 million tons but was satisfied for the most part through a 4.9% growth in domestic capacity rather than through imports, which increased 1.9%. Total U.S. paper industry exports to Japan increased 3.1%, reaching 1.6 million tons, but all of the growth was concentrated in higher sales of woodpulp (up 2.8%) and wastepaper (up 15.9%). U.S. exports of paper and paperboard fell by almost 3%.

Latin America's slight recovery. Latin America showed some slight growth in demand in 1984, although inflation, high unemployment, and heavy foreign debt continued to dampen overall demand, as did U.S. paper industry exports to the region. Total U.S. exports were slightly over 2 million tons, 4.5% higher than in 1983 but still below the prerecession high of 2.6 million tons exported in 1980.

U.S. exports to Mexico, the region's most important market, have been particularly hard hit by the country's debt problems. Mexico imposed strict control on most imports and embarked on a policy of self-sufficiency and import substitution. U.S. exports of paper, paperboard, and converted products last year were 206,000 tons, only half their 1983 level. Exports of pulp and wastepaper, however, increased from 532,000 to 717,000 tons over the same period. ■

RESEARCH & DEVELOPMENT

Spending for R&D soars, but paper lags behind

U.S. business last year boosted research and development by a surprising 14% from 1983—the biggest gain in outlays since the late 1970s, according to a recent *Business Week* survey of 820 companies. The survey included all publicly held companies with sales of at least $35 million and R&D outlays of at least $1 million, or 1% of sales.

While U.S. industry spent 2.9% of sales on R&D in 1984, up from 2% in 1983 (representing a real gain of 10% after adjusting for inflation), the paper industry devoted just 1% of sales to research—the same percentage as in 1983. On the bright side, the $314 million spent by paper companies on R&D last year represents a 7% increase over 1983 expenditures, besting earlier estimates of a 5.2% increase.

The estimates for the paper industry were based on a sample of about a dozen companies. Earlier this year, Battelle Memorial Institute's Columbus Div. estimated R&D for the entire paper industry at $596 million. ■

R&D expenditure data for the paper industry, 1984.

	Millions of dollars	Percent change from 1983	Percent of sales	R&D dollars per employee
Badger Paper Mills	0.6	7	1.2	1,421.7
Boise Cascade	7.9	31	0.2	285.7
Crown Zellerbach	15.3	5	0.5	802.1
Fort Howard Paper	6.9	106	0.5	499.5
Hammermill Paper	7.6	26	0.4	584.6
James River Corp.	23.3	27	1.0	1,109.5
Kimberly-Clark	76.8	45	2.1	2,176.6
Mead	22.0	−55	0.8	1,294.1
Scott Paper	39.8	6	1.4	1,930.0
Union Camp	32.7	23	1.7	1,846.5
Westvaco	23.2	16	1.3	1,550.3
Weyerhaeuser	45.6	−3	0.8	1,207.4
Total	**314.0**	**7**	**1.0**	**1,261.0**

Source: *Business Week* (from 10-K statements).

SAFETY

Gas leak at Champion mill will be prevented in future

A chlorine gas leak at Champion International Corp.'s Canton, N.C., mill on the morning of Aug. 19 injured 22 people. The accident occurred when the air control valve on a tank used to mix water and chlorine was inadvertently turned off, releasing chlorine gas into the air.

Of the 22 people injured from gas inhalation, only five were Champion employees; the others were construction contractors working nearby. Four of those injured were put in intensive care, but all were released from the hospital within 48 hours.

To prevent a recurrence of the accident, the valve handle on the mixing tank now requires a special tool to turn off the valve. ■

WORLD CAPACITY

World paper/board capacity expected to grow only 1.4%/year during 1984-89

World capacity for paper-grade woodpulp production will rise only 1.1%/year over the 1984-89 period, while paper and paperboard capacity will increase only 1.4%, according to the latest survey conducted by the United Nation's Food & Agriculture Organization (FAO). This compares with a 2.0% growth rate for paper and paperboard capacity in the 1979-84 period, and 2.8% from 1974-79. Pulp capacity growth rates over the same periods averaged 1.5% and 2.1%, respectively.

By 1989, world capacity for paper-grade woodpulp is expected to rise by 8.4 million metric tons to a total of 155.9 metric million tons. Capacity for paper and paperboard production would increase by 14.8 million tons, to 227.3 million tons in 1989. Last year, capacity for paper-grade woodpulp was estimated at 147.5 million tons. Capacity for paper and paperboard totaled 212.5 million tons. This represented about a 2.4% increase in woodpulp and a 3% jump in paper and paperboard capacity compared with 1983, according to the FAO's *Pulp & Paper Capacities 1984-1989*.

TABLE 1: **World woodpulp capacity, 1984-89.**

	Capacity (000 metric tons)		Annual average increase (%)	
	1984	1989	1979-84	1984-89
Developed economies	121,072	127,584	1.2	1.1
North America	73,954	77,287	1.7	0.9
Japan	12,066	12,611	−0.5	0.9
Western Europe	31,399	33,275	0.4	1.2
Oceania	2,630	2,798	3.8	1.2
Others	1,023	1,613	7.2	9.5
Developing economies	8,736	10,543	6.0	3.8
Africa	777	818	15.6	1.0
Latin America	5,962	7,342	3.9	4.3
Asia	1,997	2,383	10.6	3.6
Centrally planned economies	17,644	17,799	1.5	0.2
Asia	1,202	1,282	−14.0	1.3
Eastern Europe	4,392	4,467	3.1	0.3
U.S.S.R.	12,050	12,050	3.7	—
World total	**147,452**	**155,926**	**1.5**	**1.1**

Source: FAO Pulp & Paper Capacities, 1984-1989.

TABLE 2: **World paper and paperboard capacity, 1984-89.**

	Capacity (000 metric tons)		Annual average increase (%)	
	1984	1989	1979-84	1984-89
Developed economies	165,729	176,746	1.9	1.3
North America	82,835	87,224	1.9	1.0
Japan	23,495	25,565	1.8	1.7
Western Europe	54,729	58,506	1.7	1.3
Oceania	2,894	3,177	4.7	1.9
Others	1,776	2,274	7.2	5.1
Developing economies	20,151	23,371	6.0	3.0
Africa	1,020	1,145	7.2	2.3
Latin America	11,183	12,991	5.4	3.0
Asia	7,948	9,235	6.9	3.0
Centrally planned economies	26,587	27,224	0.1	0.5
Asia	6,040	6,284	−7.6	0.8
Eastern Europe	6,547	6,940	1.8	1.2
U.S.S.R.	14,000	14,000	4.0	—
World total	**212,467**	**227,341**	**2.0**	**1.4**

Source: FAO Pulp & Paper Capacities, 1984-1989.

The fastest growth in paper and paperboard capacity over the next five years is expected to be in the developing market economies of Asia, Africa, and Latin America with a growth rate of 3.0%/year, although this is only half the rate for the preceding five years. This compares with a rate of 1.3% for developed market economies and 0.5% for the centrally planned economies over the 1984-89 period (Table 2). The developed countries will still account for 77.7% of total paper and paperboard capacity in 1989, although the developing nations will have increased their share from 7.8% in 1979 to 9.5% in 1984 and 10.3% in 1985.

Paper grades. Capacity for major grades of paper and board in 1984 increased at a slightly faster pace than was predicted a year ago, although the rate of increase over the next five years is expected to be lower, according to the FAO.

Newsprint capacity is projected to rise from 31.2 million tons in 1984 to 33.3 million tons in 1989. This would result in an average rate of capacity expansion of 1.3%, down from 2.8% for the preceding five years. About 40% of the projected 2.1-million-ton increase in world newsprint capacity is in the developing countries. Newsprint capacity will rise by only 1.3%/year in the developed nations, with only a 0.9% rate of increase in North America.

Printing and writing paper capacity will rise from 54.8 million tons in 1984 to 61.7 million tons in 1989. This 6.8-million ton gain amounts to a 2.4% annual rate of expansion over the next five years, down from 4.1% for the 1979-84 period. Printing/writing paper capacity jumped by 3.5 million tons in 1984, an unexpectedly high rate of increase caused mainly by the addition of nearly 1 million more tons of capacity in the U.S. than had been predicted in the last survey.

Capacity for other paper and paperboard grades is expected to grow from 126.4 million tons in 1984 to 132.3 million tons in 1989. This nearly 6-million-ton increase amounts to

CHEMICALS

Chemicals help to improve quality and efficiency in U.S. paper mills

Pulp & Paper's annual survey looks at chemical developments by process; consumption and price of most chemicals appear stable in 1985

By MICHAEL J. DUCEY, Technical Editor

■ Paper production has leveled off this year, and growth has been limited to a few grades. The upward trend of white and coated sheets continues, while linerboard and newsprint grades head downward. Prices of all grades, especially market pulp, have been depressed, due primarily to the strong U.S. dollar. Imports of tissue, coated paper, bristols, and some paperboard have increased sharply; exports of these grades have declined.

Recycled grades, corrugated, and uncoated groundwood are the only bright spots for U.S. producers on the world market. Production in general has followed yearly cyclical trends but on a lower level than last year. Fourth-quarter production may dip even further, rounding out a 4% drop in total production from 1984.

Chemical use closely coincides with those production trends, particularly the chemicals used in larger volumes, such as the chloralkalies, clay, and starch, according to a survey recently conducted by *Pulp & Paper*. Chemical industry sources have complained all year about the pressure put on prices by paper manufacturers, and many have succumbed to modest discounting of several items. List prices seemed meaningless compared with the previous year.

Supply has exceeded demand for all chemicals, but the future promises change. Tight markets in caustic, titanium dioxide, and sulfur are predicted for the late 1980s. Oversupply could be common for sodium chlorate, kaolin, calcium carbonate, and hydrogen peroxide. Again, industry health as a whole should be noted—its historical correlation with the U.S.'s GNP can serve as a handy forecaster.

The chemical industry is too widespread to permit trends to be distinguished. If 1984's prices (when paper prices rose 7.2% and industrial chemicals dropped 0.4%) are any indication, no generalization about future prices can be made. Incremental price increases can be expected, except for those chemicals in oversupply.

Chemicals for power generation were not included in the survey. Conversions to coal, multifuels, and cogeneration are having a positive impact on operating costs. This should continue into the next decade unless government regulations are inhibiting.

Pulp & Paper's survey has changed from previous years to include a wider range of chemicals, comments, and graphic aids. *Pulp & Paper* invites your input on this new format. Please address all comments to the author.

PULPING. Commercial implementation of technological developments in U.S. pulping operations has been slow. Basic sulfate, sulfite, and mechanical pulping methods have not varied much during the 1980s.

Mechanical pulping developments have historically been the domain of equipment manufacturers. As more quality improvements are realized with chemical pretreatment, however, companies may be more willing to add chemicals to mechanical processes. Among the chemicals used to pretreat chips in, or after, the refiners are saltcake, caustic, and soda ash. Whether or not these chemicals will speed conversion of systems remains to be seen, but the presence of less-than-perfect wood resources also encourages conversion.

Sulfite pulping was the choice in the most recent con-

FIGURE 1: **Consumption of pulping chemicals by U.S. pulp mills.**

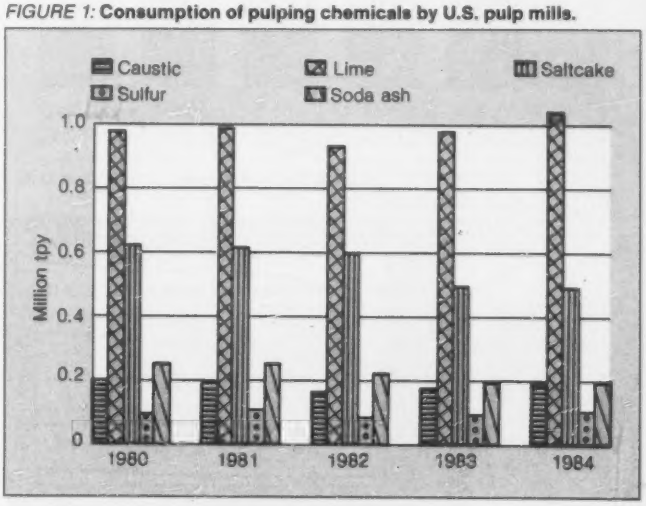


FIGURE 2: **Price history of pulping chemicals used in the U.S.**

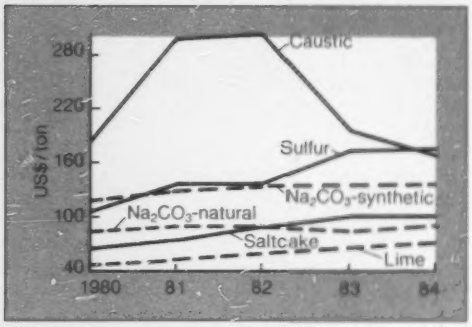


FIGURE 3: **Consumption of bleaching agents in U.S. chemical pulp mills.**

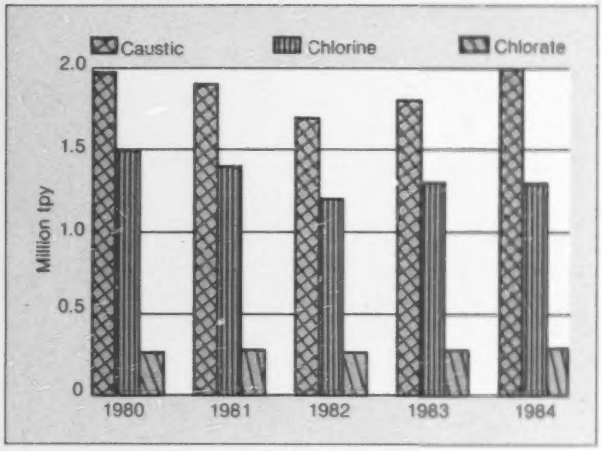


FIGURE 4: **Consumption of bleaching agents in U.S. mechanical pulp mills.**

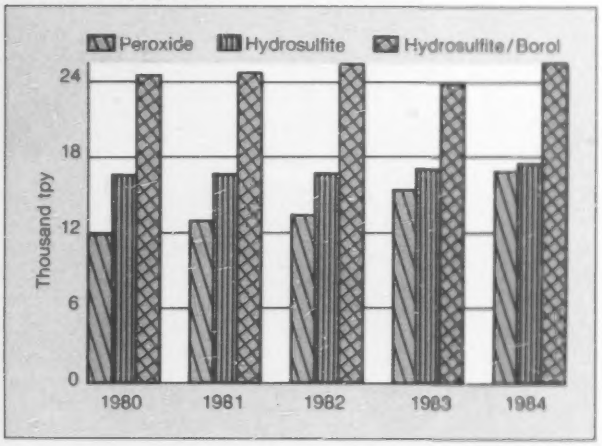
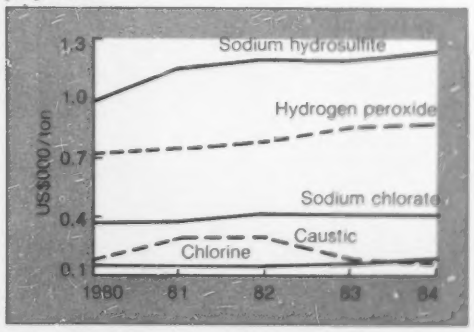


FIGURE 5: **Price history of bleaching agents in U.S. pulp mills.**



tinuous digester startup, which occurred at Crown Zellerbach Corp.'s mill in Camas, Wash. But the future for the process is still hazy for environmental and economic reasons. The Camas digester is using a magnesium bisulfite process because of operating ease and finished product quality. Other bases for sulfite include ammonia, sodium, and calcium. The last two are in decline due to uneconomical recovery and sewering restraints.

The major chemical used in the process is sulfur, which is converted to sulfur dioxide before inletting to the reactor. Caustic is used to provide the sodium requirement. The world sulfur market is currently experiencing firmer prices and tighter supply. The sulfur market is dependent on the fertilizer, oil, and natural gas industries, none of which could be labeled "stable." Frasch sulfur is now mined in only three locations in the U.S., and declining petroleum production is depressing the supply of recovered sulfur.

New sulfur may be coming out of the U.S.S.R., as that country plans to open and operate a sour gas depository on the Black Sea next year. This natural gas facility could dump 3 million tons of sulfur on the world market in its first year of operation. Several sulfite operations also use saltcake, soda ash (in liquor preparation), and other sodium- and sulfur-based chemicals. Mills with modified sulfite cooks are stressing reduced chemical charges, such as in high-yield processes.

The kraft process has not changed much over the past decade, although more attention is being given to enhancement additives and modified cooks. The chief chemicals—caustic and sodium sulfide—are now being teamed with anthraquinone to increase yields and improve quality. Widespread use of anthraquinone is curtailed by its high purchase price ($2 to $3/lb) and licensing fee (20¢/lb used). Typical additions are 2 to 4 lb/ton.

The most exciting development in kraft systems is in the area of chemical makeup, namely soda ash and saltcake. Saltcake prices have suffered this year simply because more mills are using caustic and emulsified sulfur as sodium/sulfur replacements. Prices for these two chemicals have also been low. Saltcake problems have been compounded by more efficient use of spent acid from chlorine dioxide generators and the fact that waste stream excess sulfur resulting from the use of sodium sulfate in the kraft cook cannot be reused.

The other interesting facet of kraft makeup is conversion of caustic to soda ash as the sodium base. Soda ash demand has been declining along with sulfite pulping, but new life in kraft systems is predicted for the future. Like saltcake forecasts, this depends on the price of caustic, and experts agree it may be more site specific. Consulting Resources Inc. sees conversions triggered by a 30% increase in the price of caustic, which would also strengthen saltcake consumption.

The recovery cycle of kraft mills employs calcium oxide to regenerate caustic from waste sodium carbonate solution. The lime itself is 95% recovered in the cycle. Consumption rates are closely related to production, and price and supply can be categorized as stable.

BLEACHING. The bleaching stage is the major consumer of chemicals in pulping. Demand for white pulp is high as communication papers command a larger market. This is a two-edged sword: increases in chemical addition can be offset by more efficient use of existing chemicals, reducing overall consumption.

Mechanical pulp bleaching appears to be a focal point of the chemical industry's concentration in pulp processing. The two principal methods, oxidative and reductive, are being explored both singularly and in tandem. Dithionite or sodium hydrosulfite bleaching, a reductive method, is the most common method in use today. Most mills use a single vessel to add diluted hydrosulfite to the pulp along with a sequestering agent. Another method employs sodium borohydride, caustic, and sulfur dioxide in a rapid mix with the pulp. These two bleaching formulas can also be used at, or between, refiner stages.

Industry sources suggest that borol and hydrosulfite have an equal share of reductive bleaching in the U.S. Oxidative bleaching formulas involve peroxide (hydrogen or sodium) and, to a lesser extent, hypochlorite. Some form of alkali is added for pH control, and silicates, Epsom salt, and sequestering agents are mixed in for pulp protection and buffering. Peroxide bleaching is usually carried out in a single-tower configuration or in a disk refiner stage. Two-stage mechanical pulp bleaching can have oxidative or reductive action in either order, depending on the incoming pulp and the brightness level of the desired product.

The supply of major chemicals is provided by a handful of companies. Dithionite is produced by Olin Corp. and Virginia Chemicals, the latter selling a special mix called "Z-Brite." The Ventron Div. of Morton Thiokol is still the sole supplier of borol solutions. Peroxide is manufactured by DuPont, FMC, and Interox, the last two having expanded by an additional 25,000 tons in 1985. Demand for peroxide in mechanical pulping processes is expected to climb 40% over the next five years. This has prompted the Degussa Corp. of Fed. Rep. Germany to announce the construction of a new $60-million facility in Mobile, Ala. This 36,000-tpy plant should be completed by 1987 and will incorporate the company's new bleaching concepts for both mechanical and chemical pulps in a process that uses peroxide as the primary additive.

Forecasts for chemical pulp do not show rapid, positive growth after Champion International Corp. opens its new hardwood pulping facility in Quinnesec, Mich., next year. Rumors have been circulating in the South and Southeast about a chemical pulp mill expansion, but none have been formally announced.

Bleach plants continue to improve their systems with installations of mixing equipment, automatic control, and new chemical charges. These plants have undergone extensive examination and modification for the last decade to improve efficiency and product quality and ease effluent loads.

Chemicals are a big part of this effort. The major additives—chloralkalies—are a focal point for reduction. Chlorine dioxide substitution in chlorination, oxygen addition at the caustic extraction stage, and oxygen delignification are all contributing to reducing the consumption of chlorine and sodium hydroxide. Producers of these two chemicals—20% of the market in pulp bleaching—have been frustrated by fluctuating prices. Many price increases over the year have been met with stiff resistance. Plant closures, low operating rates (less than 80% in 1985), and discounting have been the reality. One new plant has been announced for 1987 startup. Olin and DuPont will jointly operate a plant in Niagara Falls, N.Y., to produce 660 tpd of chloralkali product.

The immediate future is not much brighter for sodium chlorate producers, the chief chemical used to produce chlorine dioxide. Supply is exceeding demand, and this trend will continue throughout the decade. Discounting (as great as 20%) has become a major draw on profits as producers depress prices, citing pulp price doldrums. Growth in chlorine dioxide consumption is seen for mills built later in the century because of the chemical's environmental benefits and selectivity in bleaching out lignin. One U.S. expansion has been completed by Kemanord, which upgraded its facility in Columbus, Miss., by 33,000 tpy.

Competition from oxygen and peroxide will continue. Cheap oxygen replaces chlorine dioxide in oxidative extraction installations by a 1:2 ratio. Peroxide is cutting into bleaching sequences by oxidizing effluent in caustic extraction and whitening pulp in the later stages. Finally, as dynamic mixers and these "cheap" chemicals are explored further, new systems will use fewer stages in future bleaching sequences.

A combination of these developments is being put into practice at Weyerhaeuser Co.'s technology facility in Longview, Wash. Weyco is experimenting with a 25-tpd reactor using ozone, a chemical that has been researched and approved for bleaching. Ozone generation has become a more economical process lately as municipal wastewater treatment plants and other industries expand the commercial application of this oxidizer.

PAPERMAKING. Paper furnishes have long been the proving ground for chemical suppliers. A chemical that can extend fiber, ease operational problems, and contribute to the life of equipment has unlimited staying power—until a better, cheaper one comes along. Consumption of these wet end additives is expected to grow faster than the industry itself. One industry observer values the U.S. market at $400 million for 1985. Commodities like alum and rosin account for another $100 million. (Inorganic fillers are discussed with coatings.)

Alum consumption has been threatened by the growth of alkaline papermaking, but slow conversions to this technique have lessened the severity of the situation for now. Flat prices and discounting have hampered producers in 1985. Alum's papermaking ally, rosin, is in a similar position. Consumption is tied directly to paper and paperboard production, which has leveled off this

TABLE 1: **U.S. market for paper coating binders (tons).**

	1980	1981	1982	1983	1984
Proteineous binders	15,500	15,200	15,252	15,600	17,500
Polyvinyl alcohol	5,550	5,400	5,400	5,616	6,177
Carboxymethyl cellulose	490	464	460	470	500
Acrylic thickeners	490	490	490	493	500
Sodium alginate	50	50	50	50	50

TABLE 2: **U.S. market for paper coating latexes (tons).**

	1980	1981	1982	1983	1984
Carboxylated styrene butadiene	111,150	111,000	110,000	123,000	127,500
Polyvinyl acetate	67,195	64,000	65,975	72,500	74,000
Acrylic	16,250	16,000	16,835	18,500	18,500

year. Purchasers of rosin have been switching from dispersed to paste grades because of price and availability.

Specialty chemicals fall into several categories. All have had sustained growth over the years. Among the most successful are defoamers (valued at $20 million in U.S. papermaking), dry-strength additives (valued at $65 million), retention and drainage aids (15 to 20 million lb were consumed in 1984) and wire life extenders, coagulants, flocculants, and surfactants (appraised at about $52 million).

Biocides, a $30-million market in paper production, are experiencing tremendous growth in every U.S. industry. Industry consultant Charles H. Kline & Co. Inc. predicts the U.S.'s biocide market to be $700 million in 1988. Synthetic sizing agents, currently worth $24 million, are closely associated with alkaline papermaking conversion. Their cost is somewhat higher than common alum/rosin systems. All these chemicals mentioned are consumed at a low rate (below 0.5 lb/ton of pulp produced), and several combinations of chemicals are possible. There are well over 100 suppliers, and many more are lining up. Site-specific applications are typical. Producers see growth at 3% to 6%, with strength enhancers and influent treaters leading the way.

Another promising area of quality control for papermakers is in felt washing and conditioning. Diamond Shamrock has developed a continuous felt washing system centered around a surfactant/dispersant/coupling agent which keeps felt contaminants dispersed and away from sheet forming and pressing. Customized

FIGURE 6: **U.S. consumption of wet end additives.**

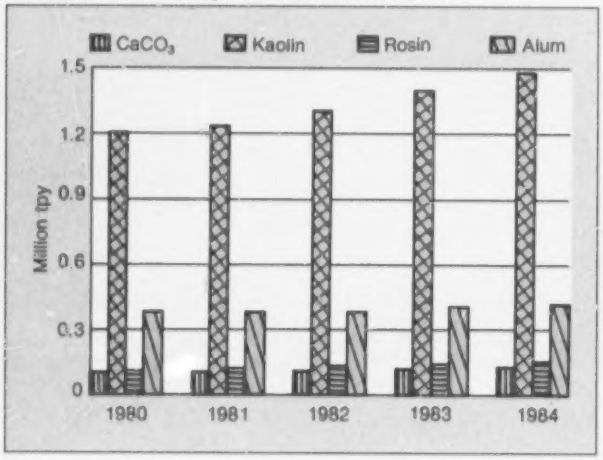


FIGURE 7: **U.S. consumption of coating materials.**

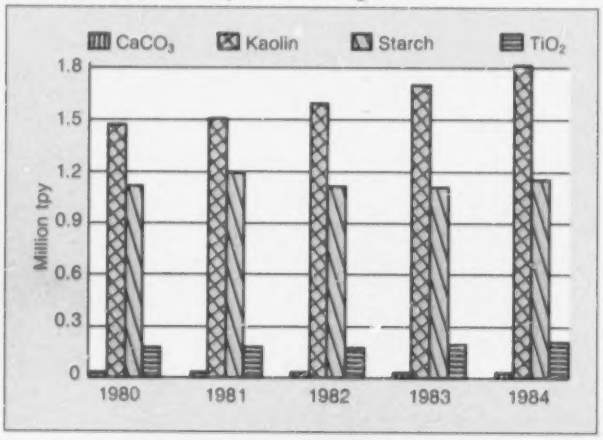


FIGURE 8: **Price history of wet end additives used in U.S. paper mills.**

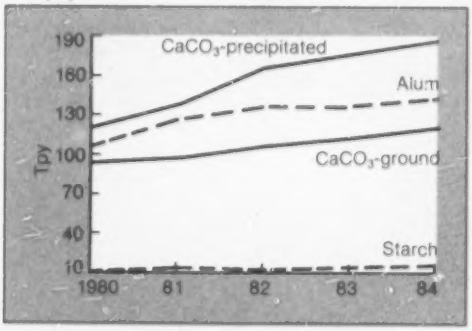


FIGURE 9: **U.S. pigment survey, coating kaolin.**

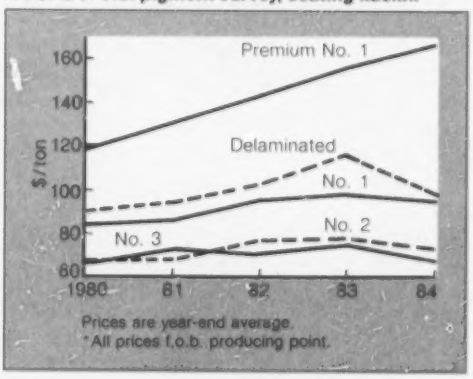


FIGURE 10: **U.S. pigment survey, urea formaldehyde, plastic pigment, zinc oxide.**

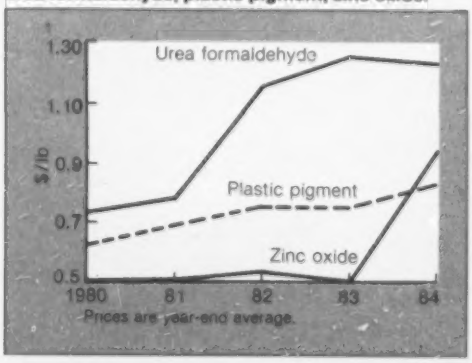
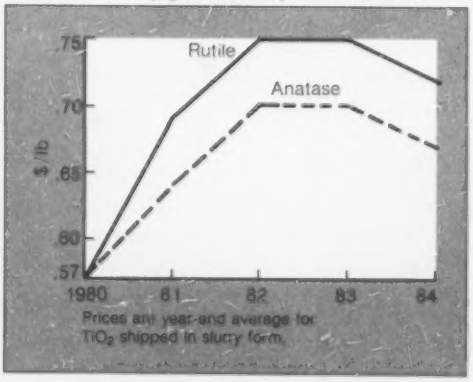


FIGURE 11: **U.S. pigment survey, titanium dioxide.**



chemical blends, typically mixed in at a rate of between 0.5 and 1.5 lb/ton (recycled grades are at the higher end), avoid "shocking" the system by adjusting to mill water pH and machine performance specifications. They extend felt life and improve moisture profiles.

The advantage of time-continuous systems over batch systems is due mainly to the elimination of downtime, helping to maintain productivity and uniformity in production. The product can be received in drum or bulk, ready to be added in a low-pressure shower aligned on the sheet side of the felt. Newsprint manufacturers have been using continuous systems for years, but as fine paper producers and others seek higher productivity through increased capacity and utilization, annual growth is seen at 10% throughout the late 1980s.

INORGANIC FILLERS, COATING. The markets for coated and filled sheets have experienced the steepest upward trend in the paper industry during the past four years. Domestic production appears to have topped out as shipments in the first half of 1985 have fallen 2% from last year. Imports of coated paper rose 85%, while exports declined 13%, according to American Paper Institute figures. Expansion announcements continue for coated paper, and chemical suppliers can expect to operate near capacity to meet these demands.

A look to the future still shows alkaline papermaking as the largest single growth area. Conversions, now adopted by nearly 10% of producers, involve switching acid-based, wet end forming to an alkaline medium. The chemicals associated with conversions are calcium carbonate, synthetic sizes, felt conditioners, retention and drainage aids (all likely to increase in consumption), and kaolin, alum, rosin, talc, titanium dioxide, and other pigments (likely to decline in consumption).

Paper formed in an alkaline medium lasts longer and offers a cost advantage to the papermaker through fiber extension (a better fiber-to-filler ratio) and chemical savings. Many suppliers of carbonate are offering new products (like "ultrafine" grades) to stay on top of the market should a quick turnaround occur. That may not be coming soon, due to resistance from paper end users.

Titanium dioxide is another filler that has experienced strong growth in this decade. Its unique ability to opacify and whiten paper is not threatened by other products, and forecasts indicate steady increases in its use. The market for slurry-based titanium dioxide has increased tremendously because of application ease and lower price. DuPont, the major supplier, is exploring the possibility of expanding its world capacity (already number one) by another 180,000 tpy with plants in Taiwan, Brazil, and South Korea.

Kaolin, as a filler and coating material, has come full circle in the 1980s. After tight supply and high prices evident early on, kaolin producers now can offer paper companies all grades at modest discounts. Suppliers are relieved at the slow growth of alkaline papermaking and are optimistic about future consumption as more newsprint producers increase loads and supercalendered sheets become a larger market. Prices could rise up to 5% next year for all grades. The export market in the South Pacific will be cut by the construction of a kaolin processing facility announced by Comalco of Australia.

Starch manufacturers have been stable suppliers to papermakers, despite feeble prices and overcapacity. About 80% of the starch shipped to paper companies is applied at the size press; the rest is in binding coating. New uses are being pushed for unmodified and modified grades at the wet end as more of the market is lost to latex cobinders. Latex affords a higher solids content and better printing surfaces than does starch.

Proteinous binders have also lost market share, as casein and soya give way to binders that exhibit lower viscosity at higher solids. Soy-based polymers have exhibited strong growth as cobinders in clay coating systems. Ralston Purina, the recognized leader in soy polymers, sees a bright future due to expanded applications with high-tech coating systems that have documented results in improved binding ability, water holding, rheology modification, and viscosity control. Polyvinyl alcohol, once thought to be the savior of binding materials, has never achieved predicted consumption rates due to poor rheological properties and difficulty in mill water chemistry. Binders such as carboxymethyl celluiose, acrylic dispersants, and sodium alginate are used mainly as water retention aids and are usually included in the formulas of synthetic latexes. Carboxylated styrene-butadiene latex is the most widely consumed latex. This chemical offers great flexibility, which should ensure its steady growth while papermakers try to accommodate the ever-changing face of the printing industry.

Although the binder-to-fiber ratio is dropping in typical systems, new paper products should offset any decline in use. Polyvinyl acetate enjoys a good piece of the coated paperboard market since it can provide high glueability and absorbancy. All synthetic latexes should encounter modest growth if the coated paper and paperboard markets keep up their current pace. Automated coating kitchens, installed in just a few places now, will up the consumption of ready coating materials. ■

FIGURE 12: **U.S. pigment survey, filling kaolin.**

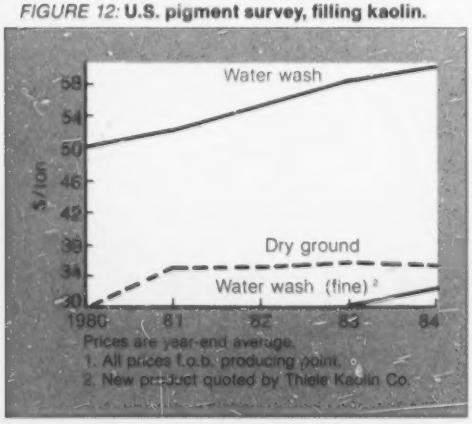
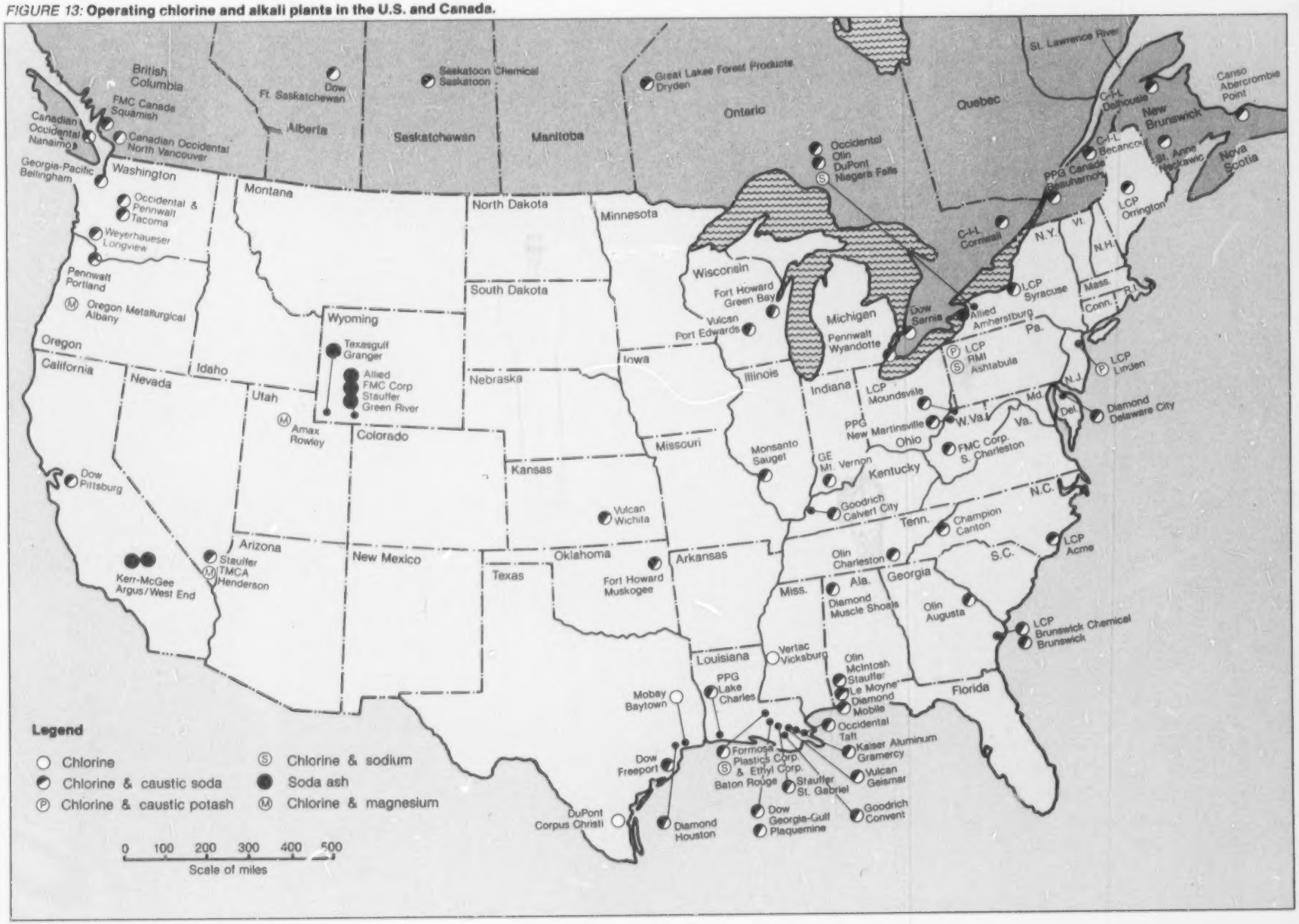


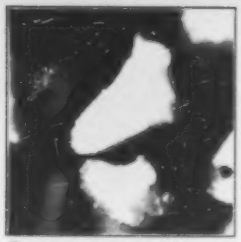
TABLE 3: **1984 consumption of chemicals for the recycled papermaking industry (short tons), and current list prices.**

Chemical	Recycling process	All pulp & paper	All industries	1985 price ($/short ton)
Caustic	12,220	2,000,000	11,600,000	$150[1]
Sodium silicate	11,421	12,500	750,000	296[2]
Sodium carbonate	11,750	200,000	8,465,000	120[3]
Hydrogen peroxide	5,000	17,000	137,000	465[4]

1. Liquid, 50%, seller's tanks, Gulf Coast works, f.o.b., freight equalized, 76% Na_2O.
2. Solid or glass, 3.22–3.25 ratio, bulk, 100-lb bags.
3. Dense, 58%, 100-lb bags, f.o.b. works.
4. 35% solution, tanks, freight equalized.

FIGURE 13: **Operating chlorine and alkali plants in the U.S. and Canada.**





CHEMICALS

Canadian pulp and paper industry increases chemical uses in 1984-85

Pulp & Paper's survey shows consumption increases in clay and peroxide; environmental additives are expected to grow rapidly in future

By MICHAEL J. DUCEY, Technical Editor

■ The Canadian pulp and paper industry is stable and expanding. Production is currently falling off somewhat from 1984 levels but by year-end will probably equal that of last year. Expansions are being announced and two new machines should be operating in the next two or three years. Output across all grades is dropping mainly because of curtailed exports and high inventories. Should the U.S. dollar weaken, all North American manufacturers would reduce inventories and resume high utilization rates.

New capacity announcements have been numerous. Two new mills are proposed for British Columbia. Makin Pulp & Paper Ltd. is planning to construct a 70,000-metric-tpy coated free-sheet mill in Britannia Beach, and Fibreco (a 35-member consortium of Canadian wood products manufacturers) is still looking for a greenfield market pulp mill site. Incremental expansions are planned for many mills from Nova Scotia to British Columbia.

This is all good news for suppliers of chemicals to Canada, but it is perhaps offset by the continued technological advances that are improving the efficiency of chemical additions. Among these are "closed-mill" concepts, mechanical equipment, and increased automatic process control. Strikes, downtime, and bad weather are also having an effect on chemical shipments to pulp and paper mills. One industry watcher predicts the Canadian industry's chemical consumption will be 3.5 million metric tpy.

The chemical industry itself is steady. Exports are helping to stem the tide against discounting and depressed prices in some markets. Major producers have announced $489 million in capital expenditures for 1985, 35% more than in 1984. New plants are also scheduled for construction during the latter half of this decade. Supply is expected to keep pace with demand, and imports are currently slowing. Chemical companies are showing small profits but not of the magnitude seen in past economic recoveries.

PULPING. Newsprint and other groundwood papers account for more than 40% of the Canadian market. These pulps are processed by mechanical means, requiring little if any chemical additions. Many producers are experimenting with chemical pretreatment using saltcake and other sodium-based compounds. The evolution of chemi-thermomechanical pulp (CTMP) and similar configurations combining chemical and mechanical pulping methods are coming of age as a few pulp lines have been converted to use these techniques. These processes will use between 20 and 50 kg of chemical per metric ton of pulp produced.

Chemical pulps have been forecast to grow at rates of 2% to 3% during the late 1980s. More chemical pulp is produced in Canada than any other kind of pulp, and chemical pulp will consume over 70% of the volume of chemicals purchased by the industry. The sulfate (kraft) pulping process is employed by 45 mills, producing 10.6 million metric tpy. Modified cooking, including increased chemical charges, is fast becoming popular due to reported increases in yield and lower energy costs. Otherwise, new developments have been slow in evolving. Pulp mills have been trading saltcake for caustic and emulsified sulfur for economic reasons. In recovery operations, the dominant chemical used is lime. Lime consumption, shown in Figure 1, includes use in wastewater treatment.

Sulfite pulping is employed at 28 Canadian mills and has been declining since the early 1970s, mostly because of mounting environmental regulations. The best forecasts indicate a steady drop in the 2.5 million metric tpy of sulfite pulp produced. Chemical charges consist of sulfur dioxide, sulfur, and sodium hydroxide in one of four base chemicals: calcium, sodium, ammonia, and magnesium. All suppliers of these chemicals say they will be able to meet demand.

Canada is the world's largest reserve holder of sulfur (even though sources say the Alberta sour gas depository wastes are currently being regenerated) and may be in the driver's seat should demand take off soon. Western Canada possesses a large reserve of saltcake and would be in an advantageous position if the price of caustic increases dramatically.

FIGURE 1: **Consumption of pulping chemicals in Canada.**

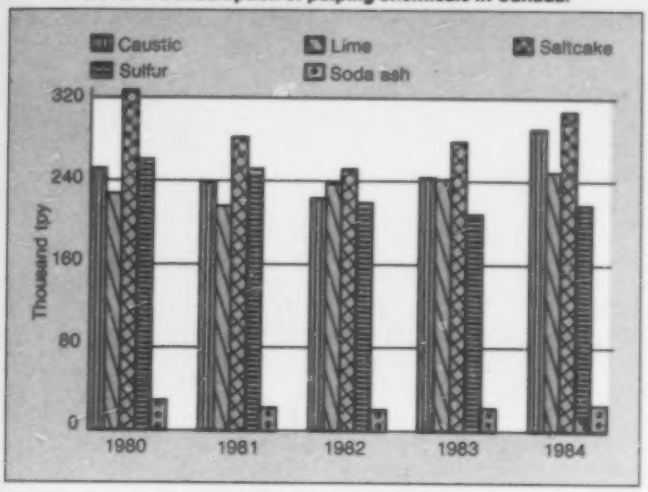
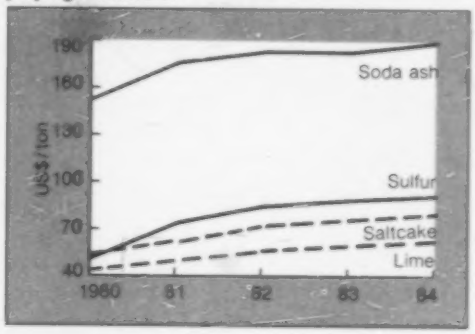


FIGURE 2: **Price history of Canadian pulping chemicals.**



There are several variations of sulfite pulping, but most industry sources agree that the wave of the future belongs to alkaline sulfite pulping. One mill will start up a system using this process in the near future.

Organosolv and other innovative pulping processes are currently being studied at many pulp and paper research institutes, but commercial applications have yet to become a reality.

BLEACHING. Mechanical pulp bleaching is a central issue in Canada, as thermomechanical pulping and other mechanical means of pulping gain a wider share of pulp production. Sodium hydrosulfite, purchased or produced onsite via the borol process, is the main chemical used to bleach mechanical pulp. No new technological developments have been reported for this one-stage, single-vessel process.

Many mills use single-stage continuous peroxide bleaching at medium and high consistency or employ two-stage peroxide-hydrosulfite for pulps of low post-brownstock brightness. These pulps are brightened to between 65 and 80 GE, whitening but not removing the lignin present. Peroxide manufacturers are counting on large growth, having announced two new mills with a total annual capacity of 46 million kg.

Demand for peroxide at the end of the decade is expected to double from present consumption but still will not fully use the new capacity. In another development, Dow Chemical has been experimenting with an onsite generator for producing a caustic solution of peroxide in a joint venture with Huron. The onsite caustic/peroxide generators will cost about $3.2 million each and could produce 10 metric tpd of peroxide.

FIGURE 3: **Consumption of bleaching agents in Canadian mechanical pulp mills.**

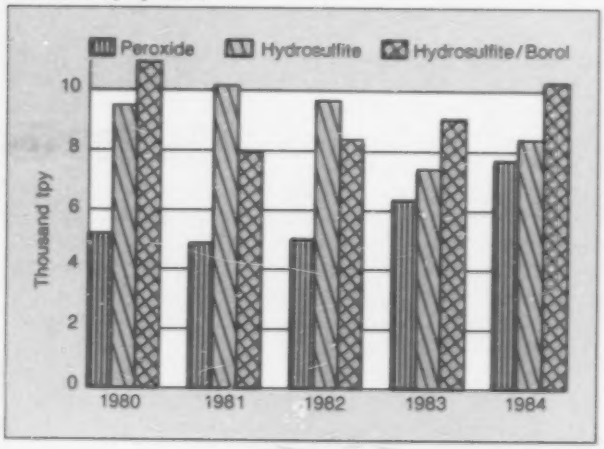
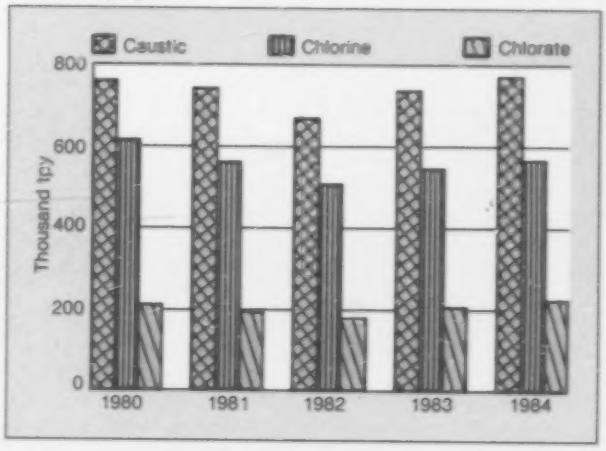
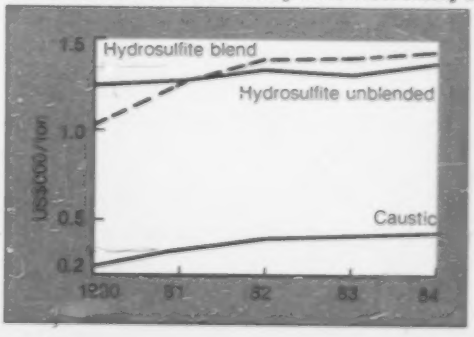
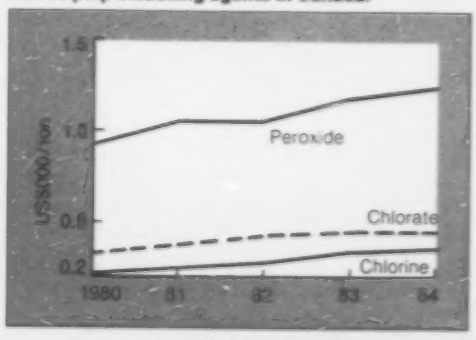


FIGURE 4: **Consumption of bleaching agents in Canadian chemical pulp mills.**



FIGURES 5A and B: **Price history of the most widely consumed pulp bleaching agents in Canada.**





Chemical pulp bleaching has always been the largest consumer of chemicals in pulp processing. High-brightness market pulp is a key export for Canada, and manufacturers have been quick to adopt applications to enhance profitability.

Chlorine is the chief chemical used to bleach chemical pulp and will remain so throughout the decade. Supplies of chloralkali chemicals appear to be adequate for now as moderate growth in their use is predicted.

Canadian bleacheries have installed oxygen systems at a pace that rivals the Scandinavians. Oxygen use will increase in commercial processes as a first-stage delignifier and in caustic extraction to ease later-stage consumption of more expensive chemicals. Other innovative uses of oxygen are also being explored in lime kiln enrichment and the larger growth area of black liquor oxidation. The consumption of metal ion chemicals, also used with oxygen as pulp protectants, will grow along with oxygen use.

The capacity for sodium chlorate, the chief reactant in the production of chlorine dioxide, is growing in Canada. Two expansions are scheduled for this year, and two more are planned for 1986. The metal electrode process is quickly replacing the old graphite method in these expansions. Exports to the U.S. market have grown steadily throughout the 1980s, and 135,000 metric tons are expected to cross the border this year (mostly bound for eastern points).

Canada enjoys a production cost advantage over the U.S. Power costs in Quebec are sometimes half of those in the southern U.S. The Canadian plants are also newer than those in the U.S. and are therefore easier to expand. Another fact worth noting is the economics in shipping. The most economical method of shipping chlorate from Canada is in crystal form, acceptance of which is growing in the U.S. Many mills can only receive chlorate solution, but as more mills desire a cheaper product cost, the installation of dissolving systems may become prevalent.

Chlorine dioxide generating systems are coming under closer scrutiny. Spent acid from older systems that is disposed of via the mills' chemical recovery systems will need to be reduced as Canadian environmental regulations dictate lower emission rates. This may bolster ways of reducing chlorine dioxide use (through oxygen and hypochlorite substitution), or it may lead to the installation of newer, more efficient generators. The consumption of methanol and other reactants used in chlorine dioxide production would thus be decreased.

PAPERMAKING. A wide range of chemicals are used in paper furnishes, and it would be impossible to cover each in detail. The papermaking process in Canada was worth over $100 million to chemical suppliers last year, the bulk consisting of alum, rosin, and specialty chemicals (excluding inorganic fillers, which will be covered with coatings.)

Rosin is mixed with the furnish to inhibit water penetration in the finished sheet. Its addition causes a pH shift which can be adjusted by mixing alum into the system, adding exact stochiometric measurements as the furnish requires, but it can be assumed that a 1:1.5 ratio of alum to rosin is the norm. Therefore, consumption growth in alum and rosin can be predicted per grade of paper consumed.

Briefly, fine papers are expected to grow at an average of 7% per year. Specialty groundwood papers are forecast to grow to 935,000 metric tpy for 1985 (common alum addition is 30 g/metric ton). Newsprint growth is leveling and will only grow at a 1% rate, as will containerboard. Finally, tissue capacity is expected to maintain a 2% annual increase through 1989.

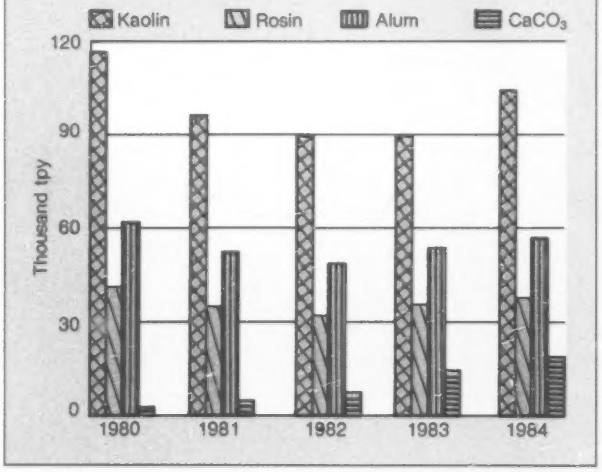
Wet end additives as a whole are usually site specific with demand and are designed to meet grade, machine, and production specifications. Charles H. Kline Co. Inc., a leading chemical consultant, has published data on these chemicals and their use. It concludes that the Canadian industry uses about $53-million worth of these chemicals annually: defoamers, $8 million; wet-strength additives, $10 million; dry-strength additives, $10 million; retention and drainage aids, $6 million; biocides $3 million; dispersants, $3 million; felt conditioners, $2 million; synthetic sizing agents, $2 million; waxes, $1 million; and another $8 million in coagulants, flocculants, flow modifiers, surfactants, and chelating agents.

INORGANIC FILLERS, COATINGS. For the past two decades, consumption of coated paper and paperboard has exceeded consumption rates for the total Canadian paper industry (on a percentage basis). This year, Canadian manufacturers should produce close to 350,000 metric tons of coated paper and another 275,000 metric tons of coated paperboard. These figures are based on *Pulp & Paper* estimates since the Canadian Pulp & Paper Assn. and Statistics Canada do not distinguish coated production from uncoated. These numbers indicate high utilization rates—in some cases over 100%. One major capacity addition in coated paper has been announced by Repap Enterprises Inc. It plans to start up a new lightweight coated machine at its Newcastle, N.B., site some time next year.

Tables 1 and 2 detail the Canadian market for paper binders and latexes, while Figure 7 describes the Canadian market for major fillers and coating materials. The growth of these products is tied to the health of the coated paper industry, which appears to be stable. An informative source has detailed the Canadian market for binders and latexes, and a few interesting points should be noted.

First, the market share and volume of natural binders

FIGURE 6: **Consumption of wet end additives in Canada.**



has decreased. Second, the volume of binders consumed has not increased as rapidly as the volume of coated paper and paperboard produced. This is attributed to the improved efficiency of modern synthetic binders and is further supported by the steadily growing use of acrylic thickeners and carboxymethyl cellulose. Another point worth raising is the decline (and near elimination) of casein use in Canada, mainly because of its price and availability problems and the increased substitution of soya and synthetics.

FIGURE 7: **Consumption of the most widely used paper coatings in Canada.**

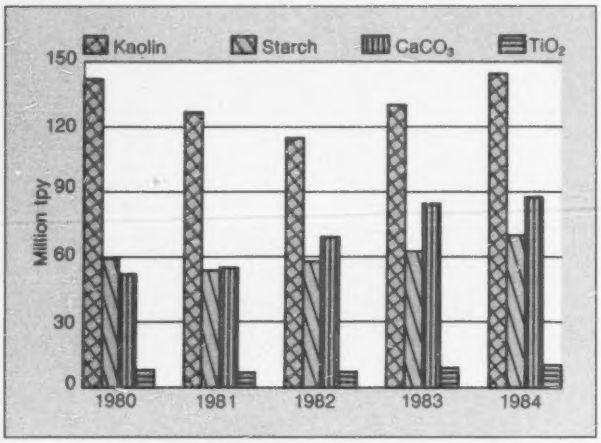


FIGURE 8: **Price history of coating materials used in Canada.**

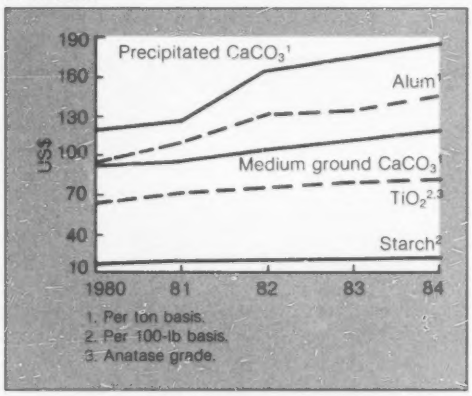


TABLE 1: **Canadian market for paper coating binders (tons).**

	1980	1981	1982	1983	1984
Starch	4,200	4,000	3,650	3,400	3,400
Proteineous binders	700	600	450	500	500
Polyvinyl alcohol	10	10	10	10	10
Carboxymethyl cellulose	60	80	110	150	155
Acrylic thickeners	25	30	70	110	115
Sodium alginate	20	15	10	10	10
Synthetic latexes	7,150	7,250	7,900	8,700	9,300
Total	**12,165**	**12,285**	**12,200**	**12,800**	**13,490**

Source: Polysar Latex.

TABLE 2: **Canadian market for paper coating latexes (tons).**

	1980	1981	1982	1983	1984
Carboxylated styrene butadiene	5,950	6,100	6,300	7,000	7,600
Polyvinyl acetate	1,000	1,150	1,400	1,550	1,700
Acrylic	200	200	200	150	100

Source: Polysar Latex.

Surface-sizing starch, mostly derived from corn, is the most popular coating material. Low price, high availability, easy application, and numerous grades account for starch's wide acceptance. Growth will remain steady throughout the 1980s, increasing with the production of boxboard, corrugating adhesives, and all surface-sized paper. The supply from U.S. sources is abundant, as is the supply from such Canadian companies as Nascan, St. Lawrence, and the newcomer, Casco (a joint venture of John LaBatt and Canadian Starch).

Growth of inorganic material use is also tied to production. Kaolin is used by paper and paperboard mills as a coating pigment (58%) and as a filler (42%)—its primary market. Canada imports its clay from the U.S. and also buys a very small amount from the U.K. There has been a minor surge in consumption for 1984 and 1985, which can be completely attributed to the economic recovery. The Canadian market for kaolin clay is valued at over $20 million. This figure could rise should newsprint manufacturers continue to add kaolin in the large amounts seen this past year.

Titanium dioxide is used to a lesser extent on a per ton basis, but its value is estimated at over $14 million. Price and supply are reliant on the paint industry, major factors being housing starts and automobile production. Canada's two producers, Tioxide and NL Chemicals, have lapsed in deliveries to paper mills. The supply gaps have been filled by U.S. companies (the only increase in chemical imports this year). In fact, NL Chemicals has met the challenge by announcing a capacity expansion that will double output at its Varennes, Que., plant by mid-1987. World supply has tightened considerably over the 1970s and 1980s, and price increases reflect these trends. Titanium dioxide consumption is increasing in paper mills at a 7% to 10% rate for 1985.

The paper industry is also the primary market for precipitated carbonates. This trend may skyrocket if Canadian producers switch to alkaline papermaking. Ground calcium carbonate shares the market equally with precipitated grades, separated only by the type and quality of the desired finished sheet.

SUMMARY. A healthy Canadian pulp and paper industry will invite chemical companies to experiment with new, innovative chemical additions as well as expand on uses for the old ones. Corpus Chemicals, an Ontario-based information firm, estimates that 3.5 million metric tons of chemicals were purchased by the industry in 1984, a 7% increase from the previous year. A mild 2% increase per year is predicted through 1988, bringing total consumption to close to 4 million metric tons. This bullish review is based on two emerging trends.

First, it is visualized that the wood base (wholetree chips, slab wood and other residuals, new species, etc.) will decline for the next decade and a half, causing greater variation in pulp quality. Thus, more pretreatment and posttreatment of pulp to improve cleanliness, yield, and brightness will be initiated by chemical use. Second, it is thought that better use of chemicals to produce paper more efficiently will open opportunities for companies experimenting with fiber extension, new product grades, and environmental systems. ■